THAT WHICH IS CLAIMED IS:

1.   A method of recovering from a failure of a
primary routing communication protocol stack which routes
communications over connections to a virtual Internet
Protocol address (VIPA) and at least one port associated
with the VIPA to a plurality of other communication
protocol stacks associated by the routing communication
protocol stack with the VIPA and the at least one port,
the method comprising:

identifying at least one of a plurality of
communication protocol stacks other than the primary
routing communication protocol stack in a cluster of data
processing systems containing the primary routing
communication protocol stack as a backup routing
communication protocol stack;

storing at the backup routing communication protocol
stack an identification of communication protocol stacks
associated with the VIPA and the at least one port as
candidate target stacks;

receiving messages at the backup routing
communication protocol stack identifying ones of the
communication protocol stacks having application
instances bound to the VIPA and listening on the at least
one port as current actual target stacks;

identifying connections to the VIPA and the at least
one port for current actual target stacks;

constructing a routing table from the received
messages identifying the connections to the VIPA so as to
provide routing path information to current actual target
stacks associated with the connection; and

routing messages on the connections to the VIPA and
the at least one port to the current actual target stacks
associated with the connections through the backup

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routing communication protocol stack utilizing the
constructed routing table.

2.   A method according to Claim 1, wherein the step
of identifying connections to the VIPA comprises the step
of receiving messages from the current actual target
stacks identifying connections to the VIPA and the at
least one port associated with the current actual target
stacks.

3.   A method according to Claim 1, further
comprising the step of:
receiving a list of communication protocol stack
addresses which are associated with the VIPA and the at
least one port; and
wherein the step of storing at the backup routing
communication protocol an identification of communication
protocol stacks associated with the VIPA and the at least
one port as candidate target stacks comprises the step of
storing the received list of communication protocol stack
addresses.

4.   A method according to Claim 3, wherein the list
further includes identification of the VIPA and ports
associated with the VIPA.

5.   A method according to Claim 1, further
comprising the step of:
defining, at the backup routing communication
protocol stack, an identification of communication
protocol stacks which are associated with the VIPA and
the at least one port so as to provide a backup list of
candidate target stacks which is different from the
candidate target stacks of the primary routing
communication protocol stacks; and

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wherein the step of storing at the backup routing communication protocol an identification of communication protocol stacks associated with the VIPA and the at least one port as candidate target stacks comprises the step of storing the backup list of candidate target stacks.

6. A method according to Claim 5, wherein the communication protocol stacks identified in the backup list of candidate target stacks are selected to reduce disruption of the cluster of data processing systems associated with the communication protocol stacks by failure of the primary routing communication protocol stack.

7. A method according to Claim 1, further comprising the step of sending the stored list to the plurality of communication protocol stacks in the cluster of data processing systems.

8. A method according to Claim 7, wherein the communication protocol stacks in the cluster of data processing systems carry out the following steps responsive to receiving the list from the backup routing communication protocol stack:

transmitting messages to the backup routing communication protocol stack identifying ones of the communication protocol stacks in the cluster of data processing systems which are identified on the list and which have application instances bound to the VIPA and listening on the at least one port;

transmitting messages to the backup routing communication protocol stack identifying connections to the VIPA and the at least one port; and

associating the backup routing communication protocol stack with the VIPA and the at least one port so

as to send subsequent messages associated with the VIPA
and the at least one port to the backup routing
communication protocol stack.

5   9.   A method according to Claim 1, further
comprising the steps of:
          detecting recovery of the primary routing
communication protocol stack; and
          transferring routing of connections to the VIPA and
10   the at least one port back to primary routing
communication protocol stack upon detection of recovery
of the primary routing communication protocol stack.

          10.   A method according to Claim 9, wherein the
15   steps of detecting recovery and transferring routing
comprise the steps of:
          receiving, at the backup routing communication
protocol stack, an identification of communication
protocol stacks associated with the VIPA and the at least
20   one port which are being routed by the backup routing
communication protocol stack from the primary routing
communication protocol stack;
          associating the primary routing communication
protocol stack with the VIPA and the at least one port at
25   communication protocol stacks having connections to the
VIPA and the at least one port or identified in the
identification from the primary routing communication
protocol stack as associated with the VIPA and the at
least one port so as to cause subsequent messages
30   associated with the VIPA and the at least one port to be
sent to the primary routing communication protocol stack;
          identifying connections to the VIPA and the at least
one port which are routed by the backup communication
protocol stack;

constructing a routing table at the primary routing
communication protocol stack from the received
identification of the connections to the VIPA so as to
provide routing path information to current actual target
5   stacks associated with the connection; and
routing messages on the connections to the VIPA and
the at least one port to the current actual target stacks
associated with the connections through the primary
routing communication protocol stack utilizing the
10   constructed routing table.

11.   A method of recovering from a failure of a
primary routing communication protocol stack which routes
messages to a predefined virtual IP address (VIPA) to a
15   predefined set of candidate target communication protocol
stacks, the method comprising:
defining a backup routing communication protocol
stack which takes ownership of routing functions for the
VIPA in the event of failure of the primary routing
20   communication protocol stack;
detecting failure of the primary routing
communication protocol stack;
determining, at the backup routing communication
protocol stack, connections to the VIPA which are
25   associated with the primary routing communication
protocol stack;
routing the determined connections to communication
protocol stacks associated with the connections through
the backup routing communication protocol stack;
30   establishing a second set of candidate target
communication protocol stacks which is different from the
predefined set of candidate target communication protocol
stacks and associated with the backup routing
communication protocol stack;

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receiving a request for a new connection to the
VIPA;

selecting a communication protocol stack from the
second set of candidate communication protocol stacks as
5   a destination for the new connection to the VIPA; and
routing messages associated with the new connection
to the selected communication protocol stack through the
backup routing communication protocol stack.

10   12. A method according to Claim 11, wherein the
second set of candidate target communication protocol
stacks are selected to reduce disruption of a cluster of
data processing systems associated with the communication
protocol stacks by failure of the primary routing
15   communication protocol stack.

13. A method according to Claim 11, further
comprising the step of sending an identification of the
second set of candidate target communication protocol
20   stacks to other communication protocol stacks in a
cluster of data processing systems.

14. A method according to Claim 13, wherein the
other communication protocol stacks carry out the
25   following steps responsive to receiving the second set of
candidate target communication protocol stacks from the
backup routing communication protocol stack:

transmitting messages to the backup routing
communication protocol stack identifying ones of the
30   other communication protocol stacks which have
application instances bound to the VIPA and listening on
a port of the VIPA;

transmitting messages to the backup routing
communication protocol stack identifying connections to
35   the VIPA; and

associating the backup routing communication
protocol stack with the VIPA so as to send subsequent
messages associated with the VIPA and the at least one
port to the backup routing communication protocol stack.

15. A method according to Claim 11, further
comprising the steps of:
    detecting recovery of the primary routing
communication protocol stack; and
    transferring routing of connections to the VIPA back
to primary routing communication protocol stack upon
detection of recovery of the primary routing
communication protocol stack.

16. A method according to Claim 15, wherein the
steps of detecting recovery and transferring routing
comprise the steps of:
    receiving, at the backup routing communication
protocol stack, an identification of candidate target
communication protocol stacks associated with the VIPA
from the primary routing communication protocol stack;
    associating the primary routing communication
protocol stack with the VIPA at communication protocol
stacks having connections to the VIPA or identified in
the received identification of candidate target
communication protocol stacks from the primary routing
communication protocol stack so as to cause subsequent
messages associated with the VIPA to be sent to the
primary routing communication protocol stack;
    identifying connections to the VIPA which are routed
by the backup communication protocol stack;
    constructing a routing table at the primary routing
communication protocol stack from the received
identification of the connections to the VIPA so as to
provide routing path information for the connections; and

routing messages on the connections to the VIPA to the communication protocol stacks associated with the connections through the primary routing communication protocol stack utilizing the constructed routing table.

17.   A system for recovering from a failure of a primary routing communication protocol stack which routes communications over connections to a virtual Internet Protocol address (VIPA) and at least one port associated with the VIPA to a plurality of other communication protocol stacks associated by the routing communication protocol stack with the VIPA and the at least one port, comprising:

means for identifying at least one of a plurality of communication protocol stacks other than the primary routing communication protocol stack in a cluster of data processing systems containing the primary routing communication protocol stack as a backup routing communication protocol stack;

means for storing at the backup routing communication protocol stack an identification of communication protocol stacks associated with the VIPA and the at least one port as candidate target stacks;

means for receiving messages at the backup routing communication protocol stack identifying ones of the communication protocol stacks having application instances bound to the VIPA and listening on the at least one port as current actual target stacks;

means for identifying connections to the VIPA and the at least one port for current actual target stacks;

means for constructing a routing table from the received messages identifying the connections to the VIPA so as to provide routing path information to current actual target stacks associated with the connection; and

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means for routing messages on the connections to the
VIPA and the at least one port to the current actual
target stacks associated with the connections through the
backup routing communication protocol stack utilizing the
5   constructed routing table.

18.   A system according to Claim 17, wherein the
means for identifying connections to the VIPA comprises
means for receiving messages from the current actual
10   target stacks identifying connections to the VIPA and the
at least one port associated with the current actual
target stacks.

19.   A system according to Claim 17, further
15   comprising:
means for receiving a list of communication protocol
stack addresses which are associated with the VIPA and
the at least one port; and
wherein the means for storing at the backup routing
20   communication protocol an identification of communication
protocol stacks associated with the VIPA and the at least
one port as candidate target stacks comprises means for
storing the received list of communication protocol stack
addresses.
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20.   A system according to Claim 19, wherein the
list further includes identification of the VIPA and
ports associated with the VIPA.

30   21.   A system according to Claim 17, further
comprising:
means for defining, at the backup routing
communication protocol stack, an identification of
communication protocol stacks which are associated with
35   the VIPA and the at least one port so as to provide a

backup list of candidate target stacks which is different from the candidate target stacks of the primary routing communication protocol stacks; and

wherein the means for storing at the backup routing communication protocol an identification of communication protocol stacks associated with the VIPA and the at least one port as candidate target stacks comprises means for storing the backup list of candidate target stacks.

22. A system according to Claim 21, wherein the communication protocol stacks identified in the backup list of candidate target stacks are selected to reduce disruption of the cluster of data processing systems associated with the communication protocol stacks by failure of the primary routing communication protocol stack.

23. A system according to Claim 17, further comprising means for sending the stored list to the plurality of communication protocol stacks in the cluster of data processing systems.

24. A system according to Claim 23, further comprising:

means for transmitting messages to the backup routing communication protocol stack identifying ones of the communication protocol stacks in the cluster of data processing systems which are identified on the list and which have application instances bound to the VIPA and listening on the at least one port;

means for transmitting messages to the backup routing communication protocol stack identifying connections to the VIPA and the at least one port; and

means for associating the backup routing communication protocol stack with the VIPA and the at

least one port so as to send subsequent messages associated with the VIPA and the at least one port to the backup routing communication protocol stack.

5   25.   A system according to Claim 17, further comprising:
means for detecting recovery of the primary routing communication protocol stack; and
means for transferring routing of connections to the
10   VIPA and the at least one port back to primary routing communication protocol stack upon detection of recovery of the primary routing communication protocol stack.

          26.   A system according to Claim 25, wherein the
15   means for detecting recovery and transferring routing comprise:
means for receiving, at the backup routing communication protocol stack, an identification of communication protocol stacks associated with the VIPA
20   and the at least one port which are being routed by the backup routing communication protocol stack from the primary routing communication protocol stack;
means for associating the primary routing communication protocol stack with the VIPA and the at
25   least one port at communication protocol stacks having connections to the VIPA and the at least one port or identified in the identification from the primary routing communication protocol stack as associated with the VIPA and the at least one port so as to cause subsequent
30   messages associated with the VIPA and the at least one port to be sent to the primary routing communication protocol stack;
means for identifying connections to the VIPA and the at least one port which are routed by the backup
35   communication protocol stack;

means for constructing a routing table at the primary routing communication protocol stack from the received identification of the connections to the VIPA so as to provide routing path information to current actual

5   target stacks associated with the connection; and

means for routing messages on the connections to the VIPA and the at least one port to the current actual target stacks associated with the connections through the primary routing communication protocol stack utilizing

10   the constructed routing table.

27.   A system for recovering from a failure of a primary routing communication protocol stack which routes messages to a predefined virtual IP address (VIPA) to a

15   predefined set of candidate target communication protocol stacks, comprising:

means for defining a backup routing communication protocol stack which takes ownership of routing functions for the VIPA in the event of failure of the primary

20   routing communication protocol stack;

means for detecting failure of the primary routing communication protocol stack;

means for determining, at the backup routing communication protocol stack, connections to the VIPA

25   which are associated with the primary routing communication protocol stack;

means for routing the determined connections to communication protocol stacks associated with the connections through the backup routing communication

30   protocol stack;

means for establishing a second set of candidate target communication protocol stacks which is different from the predefined set of candidate target communication protocol stacks and associated with the backup routing

35   communication protocol stack;

means for receiving a request for a new connection
to the VIPA;

selecting a communication protocol stack from the
second set of candidate communication protocol stacks as
5   a destination for the new connection to the VIPA; and

means for routing messages associated with the new
connection to the selected communication protocol stack
through the backup routing communication protocol stack.

10   28.   A system according to Claim 27, wherein the
second set of candidate target communication protocol
stacks are selected to reduce disruption of a cluster of
data processing systems associated with the communication
protocol stacks by failure of the primary routing
15   communication protocol stack.

29.   A system according to Claim 27, further
comprising means for sending an identification of the
second set of candidate target communication protocol
20   stacks to other communication protocol stacks in a
cluster of data processing systems.

30.   A system according to Claim 29, further
comprising:
25   means for transmitting messages to the backup
routing communication protocol stack identifying ones of
the other communication protocol stacks which have
application instances bound to the VIPA and listening on
a port of the VIPA;
30   means for transmitting messages to the backup
routing communication protocol stack identifying
connections to the VIPA; and

means for associating the backup routing
communication protocol stack with the VIPA so as to send
35   subsequent messages associated with the VIPA and the at

least one port to the backup routing communication
protocol stack.

5   31.   A system according to Claim 27, further
comprising:
        means for detecting recovery of the primary routing
communication protocol stack; and
        means for transferring routing of connections to the
VIPA back to primary routing communication protocol stack
10   upon detection of recovery of the primary routing
communication protocol stack.

        32.   A system according to Claim 31, wherein the
means for detecting recovery and the means for
15   transferring routing comprise:
        means for receiving, at the backup routing
communication protocol stack, an identification of
candidate target communication protocol stacks associated
with the VIPA from the primary routing communication
20   protocol stack;
        means for associating the primary routing
communication protocol stack with the VIPA at
communication protocol stacks having connections to the
VIPA or identified in the received identification of
25   candidate target communication protocol stacks from the
primary routing communication protocol stack so as to
cause subsequent messages associated with the VIPA to be
sent to the primary routing communication protocol stack;
        means for identifying connections to the VIPA which
30   are routed by the backup communication protocol stack;
        means for constructing a routing table at the
primary routing communication protocol stack from the
received identification of the connections to the VIPA so
as to provide routing path information for the
35   connections; and

means for routing messages on the connections to the VIPA to the communication protocol stacks associated with the connections through the primary routing communication protocol stack utilizing the constructed routing table.

33. A computer program product for recovering from a failure of a primary routing communication protocol stack which routes communications over connections to a virtual Internet Protocol address (VIPA) and at least one port associated with the VIPA to a plurality of other communication protocol stacks associated by the routing communication protocol stack with the VIPA and the at least one port, comprising:

a computer readable storage medium having computer readable program code embodied therein, the computer readable program code comprising:

computer readable program code which identifies at least one of a plurality of communication protocol stacks other than the primary routing communication protocol stack in a cluster of data processing systems containing the primary routing communication protocol stack as a backup routing communication protocol stack;

computer readable program code which stores at the backup routing communication protocol stack an identification of communication protocol stacks associated with the VIPA and the at least one port as candidate target stacks;

computer readable program code which receives messages at the backup routing communication protocol stack identifying ones of the communication protocol stacks having application instances bound to the VIPA and listening on the at least one port as current actual target stacks;

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computer readable program code which identifies connections to the VIPA and the at least one port for current actual target stacks;

computer readable program code which constructs a routing table from the received messages identifying the connections to the VIPA so as to provide routing path information to current actual target stacks associated with the connection; and

computer readable program code which routes messages on the connections to the VIPA and the at least one port to the current actual target stacks associated with the connections through the backup routing communication protocol stack utilizing the constructed routing table.

34. A computer program product according to Claim 33, wherein the computer readable program code which identifies connections to the VIPA comprises computer readable program code which receives messages from the current actual target stacks identifying connections to the VIPA and the at least one port associated with the current actual target stacks.

35. A computer program product according to Claim 33, further comprising:

computer readable program code which receives a list of communication protocol stack addresses which are associated with the VIPA and the at least one port; and

wherein the computer readable program code which stores at the backup routing communication protocol an identification of communication protocol stacks associated with the VIPA and the at least one port as candidate target stacks comprises computer readable program code which stores the received list of communication protocol stack addresses.

36. A computer program product according to Claim 35, wherein the list further includes identification of the VIPA and ports associated with the VIPA.

5   37. A computer program product according to Claim 33, further comprising:

computer readable program code which defines defining, at the backup routing communication protocol stack, an identification of communication protocol stacks

10   which are associated with the VIPA and the at least one port so as to provide a backup list of candidate target stacks which is different from the candidate target stacks of the primary routing communication protocol stacks; and

15   wherein the computer readable program code which stores at the backup routing communication protocol an identification of communication protocol stacks associated with the VIPA and the at least one port as candidate target stacks comprises computer readable

20   program code which stores the backup list of candidate target stacks.

38. A computer program product according to Claim 37, wherein the communication·protocol stacks identified

25   in the backup list of candidate target stacks are selected to reduce disruption of the cluster of data processing systems associated with the communication protocol stacks by failure of the primary routing communication protocol stack.

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39. A computer program product according to Claim 33, further comprising computer readable program code which sends sending the stored list to the plurality of communication protocol stacks in the cluster of data

35   processing systems.

40. A computer program product according to Claim 39, further comprising:

computer readable program code which transmitts messages to the backup routing communication protocol stack identifying ones of the communication protocol stacks in the cluster of data processing systems which are identified on the list and which have application instances bound to the VIPA and listening on the at least one port;

computer readable program code which transmitts messages to the backup routing communication protocol stack identifying connections to the VIPA and the at least one port; and

computer readable program code which associates the backup routing communication protocol stack with the VIPA and the at least one port so as to send subsequent messages associated with the VIPA and the at least one port to the backup routing communication protocol stack.

41. A computer program product according to Claim 33, further comprising:

computer readable program code which detects recovery of the primary routing communication protocol stack; and

computer readable program code which transfers routing of connections to the VIPA and the at least one port back to primary routing communication protocol stack upon detection of recovery of the primary routing communication protocol stack.

42. A computer program product according to Claim 41, wherein the computer readable program code which detects recovery and transferring routing comprise:

computer readable program code which receives, at the backup routing communication protocol stack, an

identification of communication protocol stacks associated with the VIPA and the at least one port which are being routed by the backup routing communication protocol stack from the primary routing communication protocol stack;

computer readable program code which associates the primary routing communication protocol stack with the VIPA and the at least one port at communication protocol stacks having connections to the VIPA and the at least one port or identified in the identification from the primary routing communication protocol stack as associated with the VIPA and the at least one port so as to cause subsequent messages associated with the VIPA and the at least one port to be sent to the primary routing communication protocol stack;

computer readable program code which identifies connections to the VIPA and the at least one port which are routed by the backup communication protocol stack;

computer readable program code which constructs a routing table at the primary routing communication protocol stack from the received identification of the connections to the VIPA so as to provide routing path information to current actual target stacks associated with the connection; and

computer readable program code which routes messages on the connections to the VIPA and the at least one port to the current actual target stacks associated with the connections through the primary routing communication protocol stack utilizing the constructed routing table.

43. A computer program product for recovering from a failure of a primary routing communication protocol stack which routes messages to a predefined virtual IP address (VIPA) to a predefined set of candidate target communication protocol stacks, comprising:

a computer readable medium having computer readable program code embodied therein, the computer readable program code comprising:

computer readable program code which defines a backup routing communication protocol stack which takes ownership of routing functions for the VIPA in the event of failure of the primary routing communication protocol stack;

computer readable program code which detects failure of the primary routing communication protocol stack;

computer readable program code which determines, at the backup routing communication protocol stack, connections to the VIPA which are associated with the primary routing communication protocol stack;

computer readable program code which routes the determined connections to communication protocol stacks associated with the connections through the backup routing communication protocol stack;

computer readable program code which establishes a second set of candidate target communication protocol stacks which is different from the predefined set of candidate target communication protocol stacks and associated with the backup routing communication protocol stack;

computer readable program code which receives a request for a new connection to the VIPA;

selecting a communication protocol stack from the second set of candidate communication protocol stacks as a destination for the new connection to the VIPA; and

computer readable program code which routes messages associated with the new connection to the selected communication protocol stack through the backup routing communication protocol stack.

44. A computer program product according to Claim 43, wherein the second set of candidate target communication protocol stacks are selected to reduce disruption of a cluster of data processing systems associated with the communication protocol stacks by failure of the primary routing communication protocol stack.

45. A computer program product according to Claim 43, further comprising computer readable program code which sends an identification of the second set of candidate target communication protocol stacks to other communication protocol stacks in a cluster of data processing systems.

46. A computer program product according to Claim 45, further comprising:
computer readable program code which transmitts messages to the backup routing communication protocol stack identifying ones of the other communication protocol stacks which have application instances bound to the VIPA and listening on a port of the VIPA;
computer readable program code which transmitts messages to the backup routing communication protocol stack identifying connections to the VIPA; and
computer readable program code which associates the backup routing communication protocol stack with the VIPA so as to send subsequent messages associated with the VIPA and the at least one port to the backup routing communication protocol stack.

47. A computer program product according to Claim 43, further comprising:

computer readable program code which detects recovery of the primary routing communication protocol stack; and

computer readable program code which transfers routing of connections to the VIPA back to primary routing communication protocol stack upon detection of recovery of the primary routing communication protocol stack.

48. A computer program product according to Claim 47, wherein the computer readable program code which detects recovery and the computer readable program code which transfers routing comprise:

computer readable program code which receives, at the backup routing communication protocol stack, an identification of candidate target communication protocol stacks associated with the VIPA from the primary routing communication protocol stack;

computer readable program code which associates the primary routing communication protocol stack with the VIPA at communication protocol stacks having connections to the VIPA or identified in the received identification of candidate target communication protocol stacks from the primary routing communication protocol stack so as to cause subsequent messages associated with the VIPA to be sent to the primary routing communication protocol stack;

computer readable program code which identifies connections to the VIPA which are routed by the backup communication protocol stack;

computer readable program code which constructs a routing table at the primary routing communication protocol stack from the received identification of the connections to the VIPA so as to provide routing path information for the connections; and

computer readable program code which routes messages on the connections to the VIPA to the communication protocol stacks associated with the connections through the primary routing communication protocol stack

5   utilizing the constructed routing table.